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(54) **TERMINAL DEVICE AND IMAGE CAPTURING METHOD**

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See application file for complete search history.

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(56) **References Cited**

U.S. PATENT DOCUMENTS

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2004/0196400 A1 \* 10/2004 Stavely et al. .... 348/333.01  
2005/0271279 A1 \* 12/2005 Fujimura et al. .... 382/203  
2008/0089587 A1 \* 4/2008 Kim et al. .... 382/190  
2008/0309799 A1 \* 12/2008 Imata ..... 348/240.3  
2009/0079813 A1 3/2009 Hildreth  
2009/0303176 A1 \* 12/2009 Chen et al. .... 345/156

(Continued)

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FOREIGN PATENT DOCUMENTS

JP 2005051472 A \* 2/2005 ..... H04N 5/232  
JP 2011-008397 1/2011  
WO WO 2010/141023 A1 12/2010

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OTHER PUBLICATIONS

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**G06F 3/00** (2006.01)

**G06F 3/03** (2006.01)

(52) **U.S. Cl.**

CPC ..... **H04N 5/23293** (2013.01); **G06F 3/005**  
(2013.01); **G06F 3/017** (2013.01); **G06F**  
**3/0304** (2013.01); **H04N 5/23219** (2013.01)

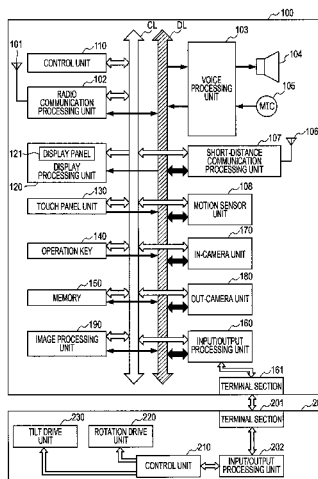
(58) **Field of Classification Search**

CPC ..... H04N 5/23293; H04N 5/225; H04N  
5/23219

(57) **ABSTRACT**

An information processing apparatus that acquires image data captured by an image capturing device; performs an analysis on the image data prior to cropping the image data for display to detect a specified image from the image data; generates an image for display by cropping the image data; controls a display to display the image for display; and executes predetermined processing when the specified image is detected in the image data as a result of performing the analysis on the image data prior to the cropping.

**13 Claims, 8 Drawing Sheets**



(56)

**References Cited**

U.S. PATENT DOCUMENTS

2010/0013943	A1 *	1/2010	Thorn .....	348/222.1	2012/0162476	A1 *	6/2012	Onoda .....	348/231.99
2011/0254972	A1	10/2011	Yaguchi		2012/0224070	A1 *	9/2012	Burroff et al. ....	348/207.1
2012/0026277	A1	2/2012	Malzbender et al.		2012/0281129	A1 *	11/2012	Wang et al. ....	348/333.01
2012/0075534	A1 *	3/2012	Katz et al. ....	348/602	2013/0021491	A1 *	1/2013	Lee et al. ....	348/222.1
					2013/0027503	A1	1/2013	Hildreth	

\* cited by examiner

FIG. 1

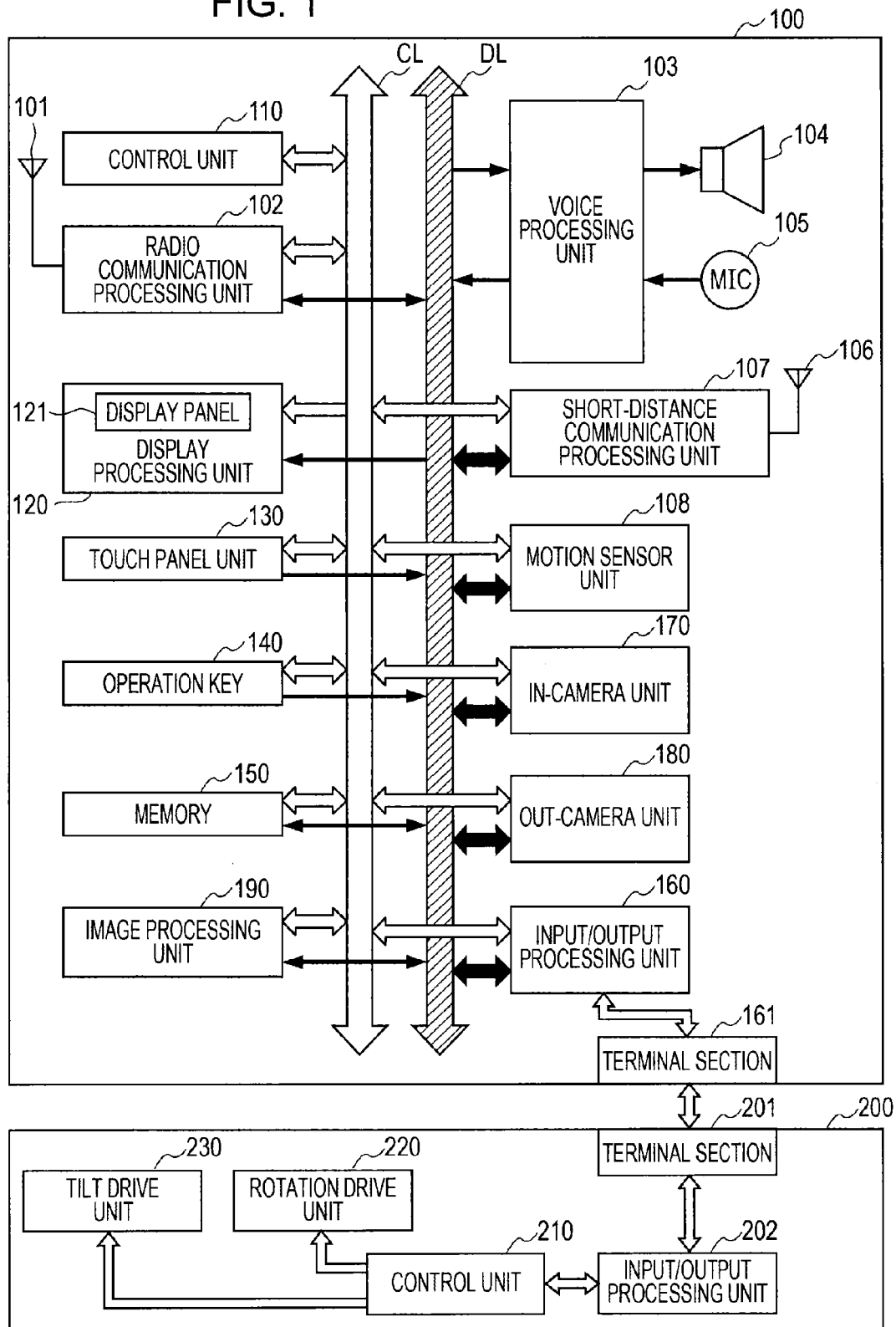


FIG. 2

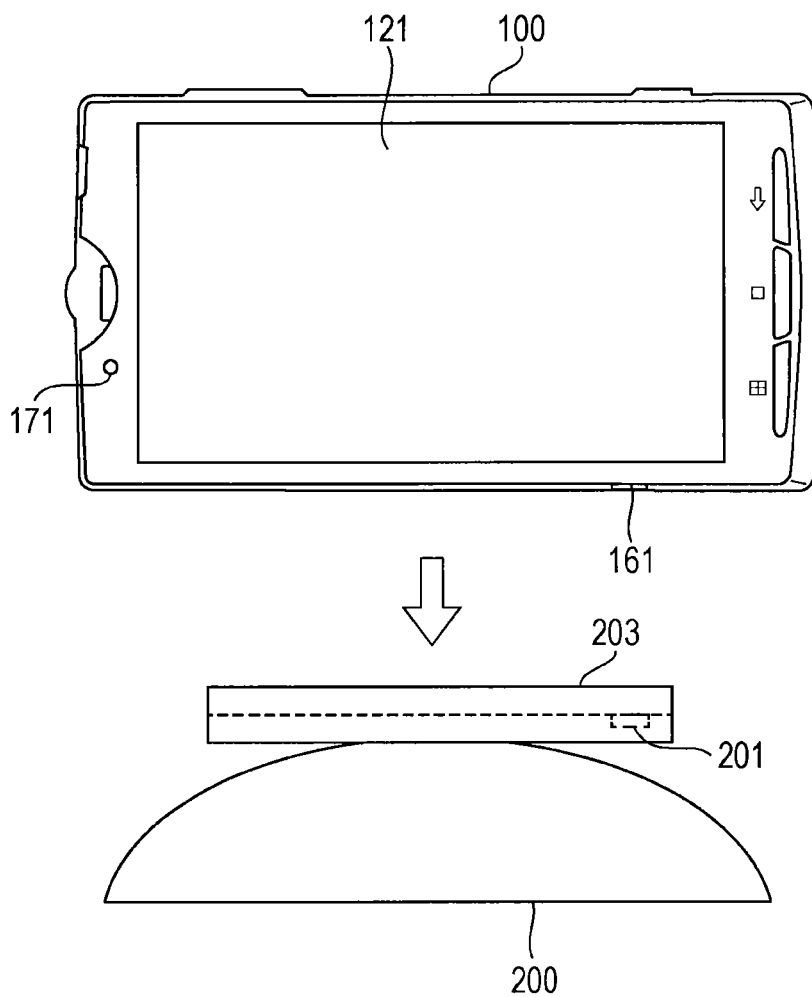


FIG. 3A

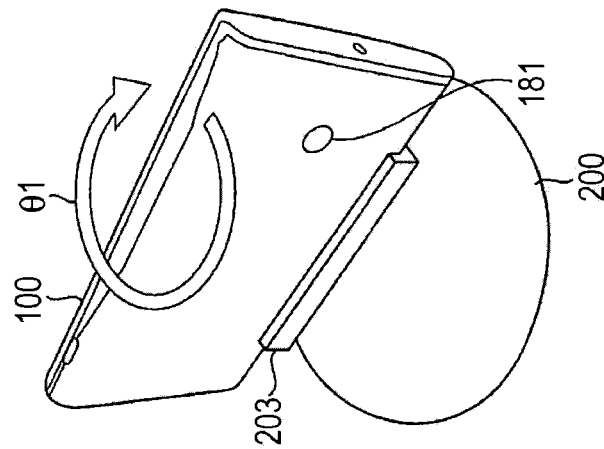


FIG. 3B

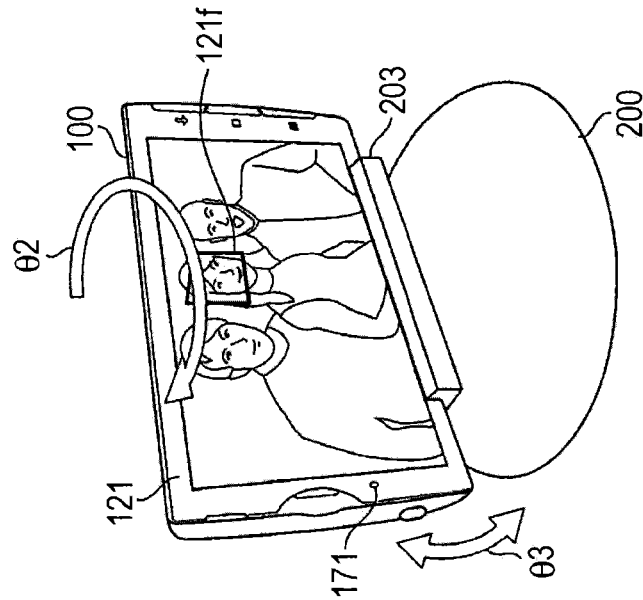


FIG. 4

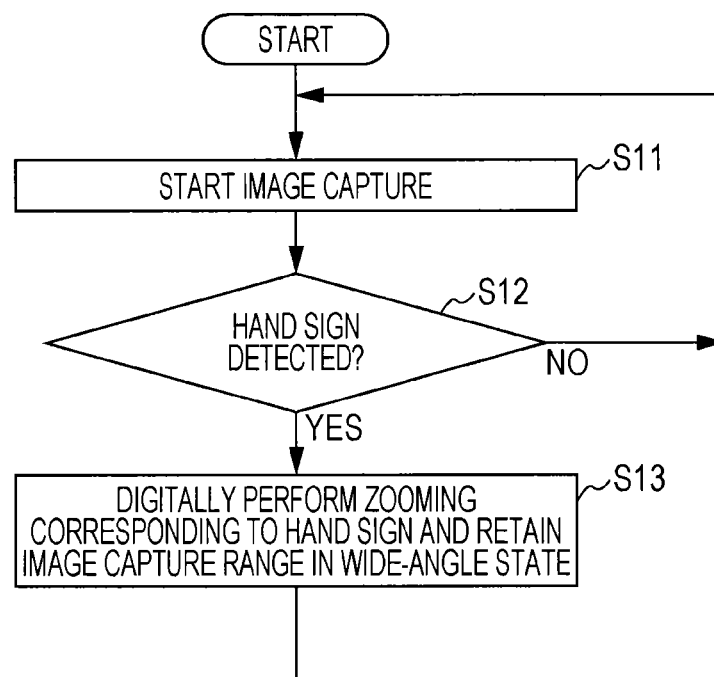


FIG. 5B

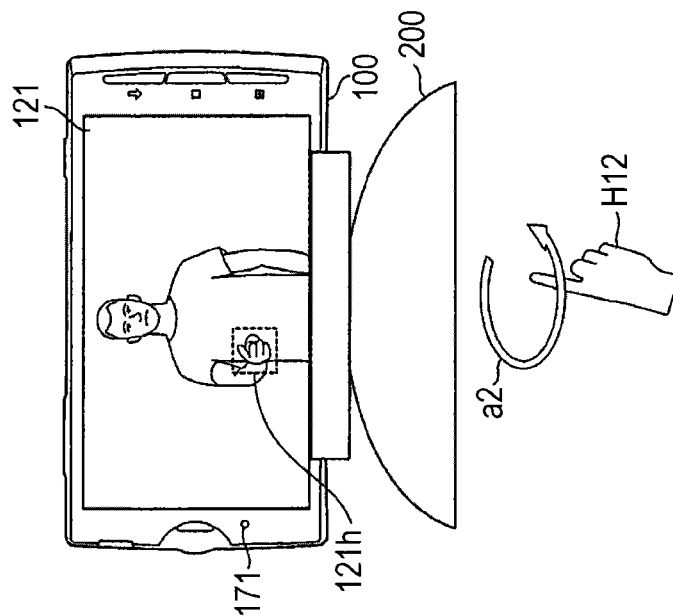


FIG. 5A

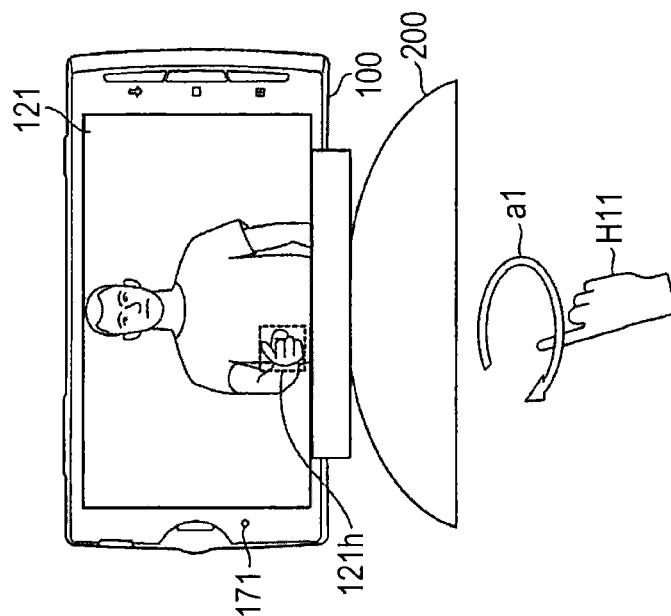


FIG. 6

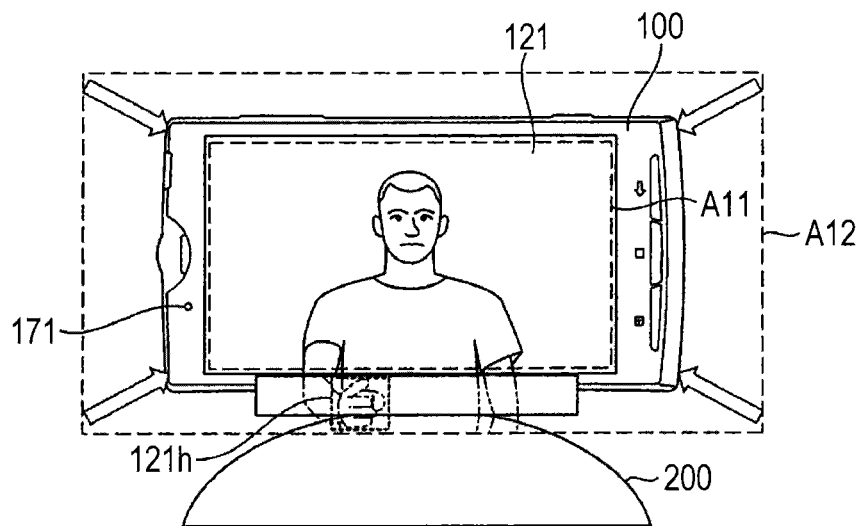




FIG. 7A

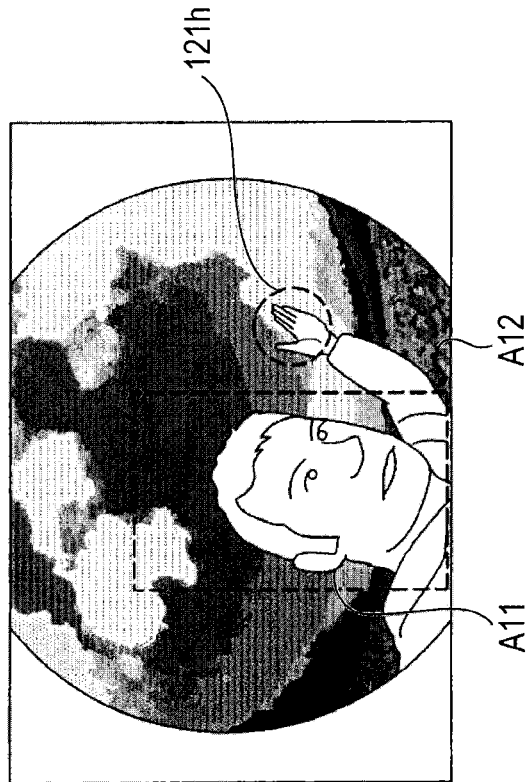


FIG. 7B

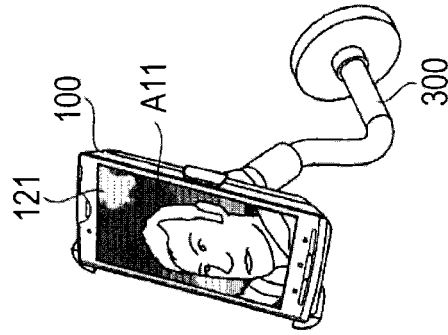


FIG. 8A

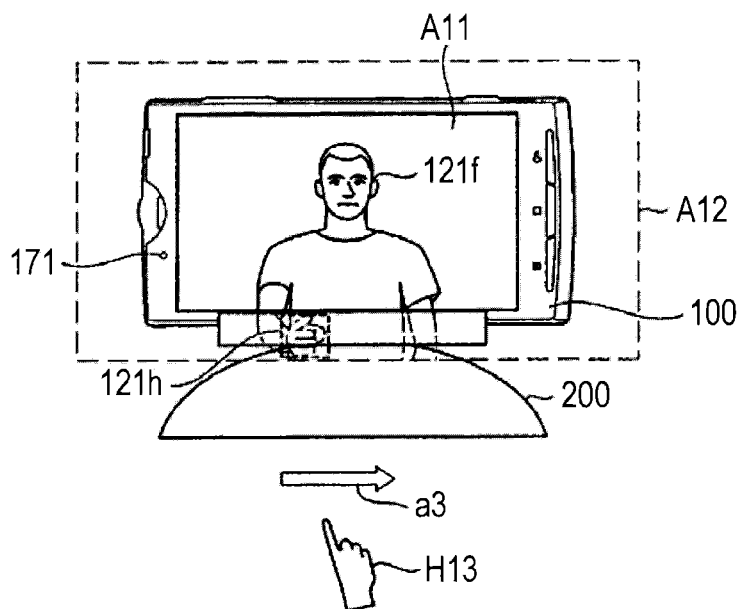
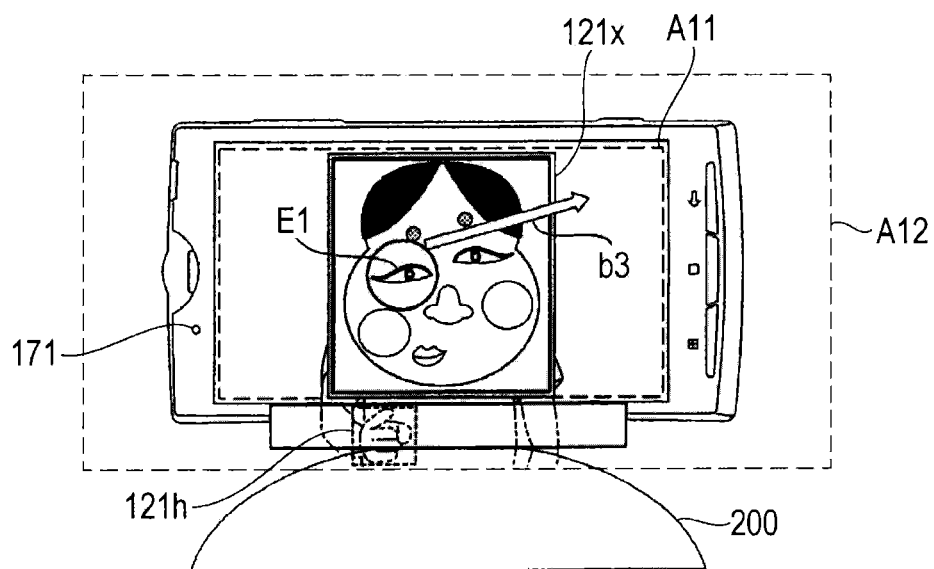


FIG. 8B



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## TERMINAL DEVICE AND IMAGE CAPTURING METHOD

### CROSS REFERENCE TO RELATED APPLICATION

The present application claims the benefit of the earlier filing date of U.S. Provisional Patent Application Ser. No. 61/657,278 filed on Jun. 8, 2012, the entire contents of which is incorporated herein by reference.

### BACKGROUND

#### 1. Field of the Disclosure

The present disclosure relates to a terminal device including a camera unit, and an image capturing method applied to the terminal device.

#### 2. Description of Related Art

In recent years, advanced mobile phone terminal devices referred to as smart phones have become widely available. The smart phone includes a camera unit, and an image captured with the camera unit is displayed on a display panel, and stored in an internal memory.

The camera unit provided in the mobile phone terminal device is used as an ordinary camera capturing images of a person, a landscape, and so forth. In addition, the camera unit may be used as a sensor for image recognition. For example, the camera unit captures the image of a barcode printed on a paper or the like, which allows the mobile phone terminal device to decode a character or a sign represented as the barcode.

When used for a video game, etc., the camera unit captures an image and the motion or the like of a target subject may be detected using the image.

In Japanese Unexamined Patent Application Publication No. 2011-8397, an example where an image captured with a camera unit of a mobile phone terminal device is used for a purpose other than display and storage is mentioned. According to the example in Japanese Unexamined Patent Application Publication No. 2011-8397, there is a mention of giving support for makeup or the like by capturing the image of a face through the camera unit of the mobile phone terminal device, and processing the captured face image.

### SUMMARY

A captured image that is used by the mobile phone terminal device to perform various types of processing through the use of the camera unit provided therein is the same as an image that is captured and displayed on the display panel. For example, when the mobile phone terminal device captures the image of a barcode and performs processing of recognizing the barcode, a user adjusts the angle of view, the image capture direction, etc. so that the barcode is included in the captured image displayed on the display panel.

However, in the case where the image displayed on the display panel in that manner agrees with a recognition target, there may be an inappropriate case depending on the mode of use.

The inventors perceive the need for appropriately recognizing an image, using a terminal device including a camera unit and an image capturing method, independently of the zoom state of the camera unit.

A terminal device of the present disclosure acquires image data captured by an image capturing device; performs an analysis on the image data prior to cropping the image data

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for display to detect a specified image from the image data; generates an image for display by cropping the image data; controls a display to display the image for display; and executes predetermined processing when the specified image is detected in the image data as a result of performing the analysis on the image data prior to the cropping.

According to the present disclosure, the image analysis is performed based on an entire image captured with the camera unit independently of the zoom state of an image provided to perform display or storage. Consequently, it becomes possible to give an instruction of specified processing by means of a sign, such as moving a hand, in the state where an image obtained by zooming up on a face, etc. is displayed.

### BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a block diagram illustrating exemplary configurations of a terminal device and a camera base according to an embodiment of the present disclosure.

FIG. 2 is a diagram illustrating exemplary external forms of a terminal device and a camera base according to an embodiment of the present disclosure.

FIGS. 3A and 3B are diagrams illustrating exemplary driven states of the terminal device according to an embodiment of the present disclosure.

FIG. 4 is a flowchart illustrating exemplary control performed during the image capturing according to an embodiment of the present disclosure.

FIGS. 5A and 5B are diagrams illustrating exemplary hand signs and motions according to an embodiment of the present disclosure.

FIG. 6 is a diagram illustrating an exemplary image capture range and an exemplary display range according to an embodiment of the present disclosure.

FIGS. 7A and 7B are diagrams illustrating another exemplary image capture range and another exemplary display range according to an embodiment of the present disclosure.

FIGS. 8A and 8B are diagrams illustrating an exemplary image capture range, an exemplary display range, and an exemplary display image according to an exemplary modification of an embodiment of the present disclosure.

### DETAILED DESCRIPTION

Examples of a terminal device and an image capturing method according to an embodiment of the present disclosure will be described with reference to drawings in the following order.

1. Configuration of terminal device (FIG. 1 to FIG. 3)
2. Exemplary processing performed based on hand signs (FIG. 4 to FIG. 6)
3. First exemplary modification (FIGS. 7A and 7B)
4. Second exemplary modification (FIGS. 8A-8B)
5. Other exemplary modifications

#### [1. Configuration of Terminal Device]

FIG. 1 is a diagram illustrating exemplary configurations of a mobile phone terminal device 100 and a camera base 200 of the present disclosure. FIG. 2 is a diagram illustrating exemplary external forms of the mobile phone terminal device 100 and the camera base 200. FIGS. 3A and 3B are diagrams illustrating examples where the camera base 200 holds the mobile phone terminal device 100.

The mobile phone terminal device 100 is an advanced terminal device referred to as a smart phone, for example, and has two built-in camera units including an in-camera unit 170 and an out-camera unit 180. The camera base 200

is a base holding a terminal device including camera units, such as the mobile phone terminal device **100**. The direction and angle of elevation of the terminal device held by the camera base **200** can be changed based on instructions from the terminal device.

The mobile phone terminal device **100** includes an antenna **101** to wirelessly communicate with a base station for radio-telephone. The antenna **101** is connected to a radio communication processing unit **102**. The radio communication processing unit **102** performs processing of the transmission and reception of a radio signal under control of a control unit **110**. The control unit **110** transmits a control instruction to the radio communication processing unit **102** via a control line CL. The control unit **110** reads a program (software) stored in a memory **150** via the control line CL and executes the program to control each unit of the mobile phone terminal device **100**. The memory **150** included in the mobile phone terminal device **100** stores prepared data, such as a program, and data generated based on a user operation. The data is stored in and read from the memory **150** under control of the control unit **110**.

Voice data for conversation, which is received by the radio communication processing unit **102** during voice conversation, is supplied to a voice processing unit **103** via a data line DL. The voice processing unit **103** performs demodulation processing on the supplied voice data to obtain an analog voice signal. The analog voice signal obtained with the voice processing unit **103** is supplied to a speaker **104**, and voice is output from the speaker **104**.

Further, the voice processing unit **103** converts a voice signal output from a microphone **105** into voice data in transmission format at during conversation. Then, the voice data converted with the voice processing unit **103** is supplied to the radio communication processing unit **102** via the data line DL. Further, the voice data supplied to the radio communication processing unit **102** is packetized and transmitted by radio.

When performing data communications or transmitting/receiving a mail via a network such as the Internet, the radio communication processing unit **102** performs processing of transmission/reception under control of the control unit **110**. For example, data received by the radio communication processing unit **102** is stored in the memory **150**, and processing such as display is performed based on the stored data, under control of the control unit **110**. Further, the data stored in the memory **150** is supplied to the radio communication processing unit **102** and transmitted by radio. When it is necessary to abandon the data of a received mail, the control unit **110** deletes the data stored in the memory **150**.

The mobile phone terminal device **100** includes a display processing unit **120**. The display processing unit **120** displays video or various types of information on a display panel **121** under control of the control unit **110**. The display panel includes a liquid crystal display panel, or an organic EL (Electro-Luminescence) display panel, for example.

Further, the mobile phone terminal device **100** includes a touch panel unit **130**. When the surface of the display panel **121** is touched by an object including a finger, a pen, and so forth, the touch panel unit **130** detects the touched position. The touch panel unit **130** includes, for example, a capacitance touch panel.

Data of the touched position detected with the touch panel unit **130** is transmitted to the control unit **110**. The control unit **110** executes a running application based on the supplied touched position.

Further, the mobile phone terminal device **100** includes an operation key **140**. The operation information of the opera-

tion key **140** is transmitted to the control unit **110**. Here, most of operations of the mobile phone terminal device **100** is performed through a touch panel operation achieved by using the touch panel unit **130**, and the operation key **140** only performs part of the operations.

Further, the mobile phone terminal device **100** includes a short-distance communication processing unit **107** to which an antenna **106** is connected. The short-distance communication processing unit **107** performs short-distance communications with a nearby terminal device or access point. The short-distance communication processing unit **107** performs radio communications with a destination which is in a range of about several tens of meters, for example, by employing a wireless LAN (Local Area Network) system defined as IEEE 802.11 standard, etc.

Further, the mobile phone terminal device **100** has a motion sensor unit **108**. The motion sensor unit **108** includes a sensor detecting the motion or direction of the device, such as an acceleration sensor, a magnetic field sensor, etc. The acceleration sensor detects accelerations that are measured in three directions including a length, a width, and a height, for example. Data detected with the motion sensor unit **108** is supplied to the control unit **110**. The control unit **110** determines the state of the mobile phone terminal device **100** based on the data supplied from the motion sensor unit **108**. For example, the control unit **110** determines whether a cabinet constituting the mobile phone terminal device **100** is vertically oriented or horizontally oriented based on the data supplied from the motion sensor unit **108**, and controls the orientation of an image displayed on the display panel **121**.

Further, the mobile phone terminal device **100** includes an input/output processing unit **160**. A terminal section **161** is connected to the input/output processing unit **160**, and the input/output processing unit **160** performs input processing and output processing of data with a device connected to the terminal section **161**. In the example of FIG. 1, the terminal section **161** is connected to a terminal section **201** of the camera base **200**. The connection between the terminal section **161** of the mobile phone terminal device **100** and the terminal section **201** of the camera base **200** is established through the direct connection between the terminal sections **161** and **201**. However, the connection between the terminal sections **161** and **201** may be established through a transmission cable.

Further, the mobile phone terminal device **100** has the two camera units including the in-camera unit **170** and the out-camera unit **180**. The in-camera unit **170** is a camera unit capturing an image of an inside when a side on which the display panel **121** of the mobile phone terminal device **100** is provided is determined to be the inside. The out-camera unit **180** is a camera unit capturing an image of an outside which is a side opposite to the side on which the display panel **121** is provided. Lenses **171** and **181** (FIGS. 3A and 3B) that are included in the camera units **170** and **180**, respectively, are provided, for example, as wide-angle lenses, which allow the camera units **170** and **180** to capture images of relatively wide areas.

The control unit **110** performs control to switch image capturing between the image capturing performed through the in-camera unit **170** and that performed through the out-camera unit **180**.

The data of images that are captured with the in-camera unit **170** and the out-camera unit **180** is supplied to an image processing unit **190**. The image processing unit **190** converts the supplied image data into image data of the size (pixel number) for storage. Further, the image processing unit **190** performs processing to set the zoom state where the image

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of a specified range is cut from the image data captured with the camera units **170** and **180**, and enlarged. The zoom processing performed through the image cutting is referred to as digital zooming.

Further, the image processing unit **190** performs processing to analyze the captured image, and processing to determine the details of the image. For example, the image processing unit **190** performs processing to detect the face of a person included in the image. Information about the face detected with the image processing unit **190** is supplied to the control unit **110**. The control unit **110** controls the image capturing state of a range that should be brought into focus, etc. based on the supplied face information.

Further, the image processing unit **190** performs processing to detect a predetermined specified hand gesture from the image. In that case, an area from which the image processing unit **190** detects the specified hand gesture is determined to be the entire area of an image detected with the in-camera unit **170** regardless of an enlarged state during the above-described digital zoom processing. That is, the image processing unit **190** detects the specified hand gesture from a wide-angle image captured with the in-camera unit **170**.

Information about the hand gesture detected with the image processing unit **190** is supplied to the control unit **110**. The control unit **110** controls the image capturing state based on the supplied hand gesture information. A specific example where the control unit **110** controls the image capturing state based on the hand gesture detection will be described later.

The in-camera unit **170** and the out-camera unit **180** capture images at regular intervals of thirty frames per second, etc. An image captured by a running camera unit out of the in-camera unit **170** and the out-camera unit **180** is displayed on the display panel **121**. Then, the control unit **110** stores in the memory **150** an image captured at the time when a shutter button operation (shooting operation) performed by a user is detected. The shooting operation is performed through the use of the touch panel unit **130**, for example. Further, in the state where the camera base **200** is connected, which will be described later, the control unit **110** automatically controls image capturing.

The in-camera unit **170** and the out-camera unit **180** may include a flash unit which illuminates a subject by emitting light at the shooting time when a captured image is stored in the memory **150**.

Next, the configuration of the camera base **200** will be described with reference to FIG. 1.

The camera base **200** is a device provided to hold the mobile phone terminal device **100**, and has the terminal section **201** connected to the terminal section **161** of the held mobile phone terminal device **100**. An input/output processing unit **202** performs communications with the mobile phone terminal device **100** via the terminal section **201**. Information received by the input/output processing unit **202** is supplied to a control unit **210**. Further, the information supplied from the control unit **210** to the input/output processing unit **202** is transmitted from the terminal section **201** to the mobile phone terminal device **100** side.

The control unit **210** controls a rotation by a rotation drive unit **220**, and controls a tilt angle formed by a tilt drive unit **230**. The rotation drive unit **220** includes a motor provided to rotate the mobile phone terminal device **100** held by the camera base **200**, and sets the rotation angle of the mobile phone terminal device **100** to an angle specified from the control unit **210**. The tilt drive unit **230** includes a drive mechanism that makes the tilt angle of the mobile phone

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terminal device **100** held by the camera base **200** variable, and sets the tilt angle to an angle specified from the control unit **210**.

FIG. 2 is a diagram illustrating an exemplary form of the mobile phone terminal device **100**.

The mobile phone terminal device **100**, which is configured as a smart phone, has the display panel **121** arranged on the surface of a vertically oriented cabinet. Note that, in FIG. 2, the mobile phone terminal device **100** placed in the horizontally oriented state is illustrated.

The lengths of diagonals of the display panel **121** are about 10 centimeters, for example. The display processing unit **120** drives the display panel **121** to perform display thereon. Further, the touch panel unit **130** detects the touch of a finger, etc. on the surface of the display panel **121**. Further, the mobile phone terminal device **100** has a lens **171** of the in-camera unit **170** (FIG. 1), which is arranged adjacent to the display panel **121**. The arrangement of the lens **171** allows the in-camera unit **170** to capture an image of the side on which the display panel **121** is provided. Further, though not illustrated, the lens of the out-camera unit **180** (FIG. 1) is arranged on the face opposite to the face on which the display panel **121** is provided.

Then, the mobile phone terminal device **100** is placed on a terminal holding part **203** provided on the upper side of the camera base **200**, as illustrated in FIG. 2. Placing the mobile phone terminal device **100** on the terminal holding part **203** causes the terminal section **161** of the mobile phone terminal device **100** and the terminal section **201** of the camera base **200** to be connected. In the connection state, the rotation position or tilt angle of the camera base **200** is set based on instructions from the mobile phone terminal device **100**.

FIGS. 3A and 3B are perspective views illustrating the state where the mobile phone terminal device **100** is held by the camera base **200**. As illustrated in FIGS. 3A and 3B, the camera base **200** retains the display panel **121** of the mobile phone terminal device **100** in a nearly upright state, and rotates in horizontal directions as indicated by arrows  $\theta 1$  and  $\theta 2$ .

Further, the tilt angle of the mobile phone terminal device **100** is variable as indicated by an arrow  $\theta 3$ . Here, in the state where the mobile phone terminal device **100** is held by the camera base **200** as illustrated in FIGS. 3A and 3B, the in-camera unit **170** performs image capturing, and an image captured with the in-camera unit **170** is displayed on the display panel **121**. As illustrated in FIG. 3B, the lens **171** of the in-camera unit **170** and the display panel **121** are arranged on the same surface of the cabinet. Consequently, the in-camera unit **170** can capture the image of a person who is in front of the mobile phone terminal device **100**, and the person who is being subjected to the image capturing can be confirmed based on an image displayed on the display panel **121**, which is being captured. When the image processing unit **190** detects the person's face from the image captured with the in-camera unit **170**, a frame **121f** indicating the face displayed on the display panel **121** is displayed as illustrated in FIG. 3B. The lens **181** of the out-camera unit **180** is arranged on a face opposite to the face on which the display panel **121** is provided as illustrated in FIG. 3A.

Then, the control unit **110** controls the image capturing based on the detected state of the shape or motion of a hand of the user.

[2. Exemplary Processing Performed Based on Hand Signs]

A flowchart of FIG. 4 illustrates processing performed by the in-camera unit **170** that captures an image in the state where the mobile phone terminal device **100** is held by the camera base **200**. The image capturing with the in-camera

unit **170** is controlled by the control unit **110**. An image captured with the in-camera unit **170** is displayed on the display panel **121**.

First, the control unit **110** starts image capturing with the in-camera unit **170** (step **S11**). When the image capturing is started, the image processing unit **190** that processes an image captured with the in-camera unit **170** selects a wide-angle state where the angle of view is maximized as the zoom processing state, and changes the zoom processing state in accordance with a user operation.

Then, the control unit **110** determines whether or not a hand sign is detected from a captured image through the image analysis performed with the image processing unit **190** (step **S12**). Here, the hand sign denotes a sign including a predetermined shape or motion of a hand, or a combination of the shape and the motion of the hand. Specific examples of the hand sign will be described later. When no hand sign is detected through the determination made at step **S12**, the control unit **110** continuously performs the image capture at step **S11**.

Then, when the hand sign is detected at step **S12**, the control unit **110** performs operation control corresponding to the hand sign (step **S13**). At that time, when the zoom-processing state includes zoom-in processing of enlarging an image from the wide-angle state, the image processing unit **190** determines the range of an image cut from the captured image in accordance with the zoom magnification. The image displayed on the display panel **121** is changed to the cut image. Further, at the shooting time, the memory **150** stores the image cut with the image processing unit **190** in accordance with the zoom magnification at that time. Further, the area from which the image processing unit **190** detects the hand sign at step **S13** corresponds to an entire image captured with the in-camera unit **170** regardless of the zoom magnification at that time.

Then, after performing the control corresponding to the hand sign at step **S13**, the control unit **110** returns to the processing of step **S11**.

Next, an example of the hand sign detected at step **S13** of the flowchart of FIG. **4** will be described. According to an example of the present disclosure, a hand sign made to control the image capturing state is predetermined, and the image processing unit **190** detects a hand sign of the predetermined pattern from a captured image. The hand sign made to control the image capturing state includes, for example, the following hand signs described in (a) to (e):

- (a) a hand sign made to specify a horizontal rotation of the camera base **200**;
- (b) a hand sign made to specify an increase or decrease in the tilt angle of the camera base **200**;
- (c) a hand sign made to specify zooming of a captured image;
- (d) a hand sign made to specify an image frame; and
- (e) a hand sign made to perform shooting control.

The user that is the subject moves his/her own hand to make these hand signs. Consequently, the image processing unit **190** of the mobile phone terminal device **100** detects the hand signs through the image recognition, and the control unit **110** performs the corresponding control.

Next, an example where the zoom state is controlled will be described, as an exemplary hand sign.

FIGS. **5A** and **5B** illustrate exemplary hand signs that are made to control the zoom state. FIG. **5A** illustrates a zoom-in hand sign **H11**, and FIG. **5B** illustrates a zoom-out hand sign **H12**.

FIG. **5A** illustrates the hand sign **H11** of placing a single finger in an upright position and rotating the tip of the

upright finger counterclockwise. The image processing unit **190** detects the hand sign **H11**, which causes the control unit **110** to issue a zoom-in instruction to the image processing unit **190**. With the issued zoom-in instruction, an image displayed on the display panel **121** is gradually enlarged, and an image stored at the shooting time is also enlarged correspondingly.

FIG. **5B** illustrates the hand sign **H12** of placing a single finger in an upright position and rotating the tip of the upright finger clockwise. When the image processing unit **190** detects the hand sign **H12**, the control unit **110** issues a zoom-out instruction to the in-camera unit **170** or the image processing unit **190**. With the issued zoom-out instruction, an image displayed on the display panel **121** is gradually reduced, and the image stored at the shooting time is also reduced correspondingly.

In each of the examples illustrated in FIGS. **5A** and **5B**, the hand of the subject making the hand sign is displayed in the image on the display panel **121**. Here, the mobile phone terminal device **100** of the present disclosure detects a hand sign from the image of an entire range, the image being captured with the in-camera unit **170**.

FIG. **6** is a diagram illustrating an example where the image processing unit **190** detects a hand sign from an area outside the display range of the display panel **121**.

In the example of FIG. **6**, an image **A11** displayed on the display panel **121** is a zoomed-in image obtained by enlarging the center part of an image **A12** captured with the in-camera unit **170**. At the shooting time, the data of the image **A11** cut from the image **A12** is stored in the memory **150**. In FIG. **6**, the range of the image **A12** is virtually indicated by a broken line.

At that time, the image processing unit **190** detects through the image analysis a hand sign **121h** from the image **A12** of the entire range which is captured and acquired with the in-camera unit **170**.

For example, as illustrated in FIG. **6**, the image processing unit **190** detects the hand sign **121h** within the image **A12** outside the display image **A11**. At that time, the control unit **110** determines the details of an instruction based on the shape or motion of the hand, which is detected with the image processing unit **190** as the hand sign **121h**.

On the basis of the detection of the hand sign **121h**, the control related to image capturing, such as the zoom-in or the zoom-out, is performed, as is the case with the examples of FIGS. **5A** and **5B**. For example, when the zoom-in hand sign is detected from a result of the image analysis made by the image processing unit **190**, the control unit **110** issues a zoom-in instruction to the image processing unit **190**. With the issued zoom-in instruction, an image displayed on the display panel **121** is gradually enlarged and an image stored at the shooting time is also enlarged correspondingly. The zoom-in is one example of operations indicated by the hand signs, and the image processing unit **190** can detect any of the hand signs that had already been described in (a) to (e).

Thus, since the hand sign is detected from a wide-angle image captured with the in-camera unit **170** even though an image that is displayed and stored through the zoom processing becomes a part of the captured image range, the mobile phone terminal device **100** of the present disclosure appropriately issues an operation instruction by means of the hand sign. For example, even though the zoom processing is performed so as to enlarge the area around the face of a person that is a subject, the mobile phone terminal device **100** can detect a hand sign made by the motion of a hand of the person, so that an operability achieved by means of the hand sign is ensured. Particularly, the image capturing is

allowed while the hand of the person that is the subject is not displayed, the mobile phone terminal device **100** of the present disclosure can attain both the operability achieved by means of the hand sign and the flexibility of composition. [3. First Exemplary Modification]

FIGS. **7A** and **7B** are diagrams illustrating another example of the image capturing state.

In this example, a person that is a subject stands in front of a given background image and gives an explanation of the background image. The background image is, for example, an image projected by a projector apparatus.

When such a system is provided, the in-camera unit **170** provided in the mobile phone terminal device **100** captures a wide-angle image of the surroundings of the subject. An image **A12** illustrated in FIG. **7A** is the image of an entire range, which is captured with the in-camera unit **170**. Here, an image **A11** displayed on the display panel **121** of the mobile phone terminal device **100** is an image obtained by cutting the face of the person that is the subject. FIG. **7B** is a diagram illustrating the image **A11** displayed on the display panel **121** of the mobile phone terminal device **100**. In this example, the mobile phone terminal device **100** is held by a holding base **300**.

Then, the person that is the subject performs an operation relating to the background image for the projector apparatus through the hand sign **121h** made by using a hand. For example, an operation is performed to change the background image to another image based on an instruction by means of the hand sign.

In that case, in the mobile phone terminal device **100**, the control unit **110** determines the instruction based on the hand sign **121h** detected with the image processing unit **190** through the image recognition. When the control unit **110** determines, with the above determination, that the hand sign specifies an operation of the projector apparatus, the command corresponding to the hand sign is transmitted from the mobile phone terminal device **100** to the projector apparatus. Thus, the hand sign made beyond the display range can give an instruction to an apparatus provided outside the terminal device.

Thus, giving an instruction to the apparatus provided outside the terminal device by means of the sign made beyond the image capture range allows a photographer to control the outside apparatus by his/her own hand, etc. without affecting a captured image. [4. Second Exemplary Modification]

FIGS. **8A** and **8B** are diagrams illustrating still another example of the image capturing state.

In this example, the mobile phone terminal device **100** is executing a video game in which the image of a face captured with the in-camera unit **170** is processed. FIG. **8A** illustrates an example where the in-camera unit **170** performs image capturing, and the display panel **121** displays the image. In this example, as illustrated in FIG. **8A**, the hand sign **121h** made by a hand of the subject is detected within an image **A12** of an entire range outside an image **A11** of a display range.

FIG. **8B** illustrates an example where the display panel **121** displays an image **121x** obtained by modifying and processing the captured face image. This example is a video game in which the positions of parts including the eyes or the nose constituting the processed face can be changed as desired in accordance with hand signs. For example, as illustrated in FIG. **8A**, assuming that the user makes a hand sign **H13** indicating a movement in an upper-right direction **a3**, the position of an eye **E1** included in the processed face image **121x** is then moved in a specified upper-right direc-

tion **b3** as illustrated in FIG. **8B**. Thus, it becomes possible to provide an instruction to execute a video game by means of the hand sign made beyond the display range.

Thus, operations are performed by means of the signs that are made beyond the display range during the execution of a video game, etc., which allows for controlling the video game without affecting a captured image.

[5. Other Exemplary Modifications]

The exemplary hand signs that are illustrated in the drawings indicate one example, and other hand signs may be applied. Further, other operations that are not described in the above-described embodiments may be executed based on hand signs. Although the examples where the control is performed based on the hand signs that are made by the shape or the motion of a hand have been described, a sign made by using anything other than the hand can also be used for the control. For example, an instruction is given through a motion such as moving a foot.

Further, in the above-described embodiments, the example where the connection is established between the mobile phone terminal device **100** configured as a smart phone and the camera base **200** is described. On the other hand, the connection may be established between another terminal device and a camera base. For example, the connection may be established between a terminal device configured as an electronic still camera and a camera base.

Further, a program (software) executing the control processing described in the flowchart of FIG. **4** may be generated, and the program may be stored in a storage medium. Preparing the program stored in the storage medium allows a terminal device in which the program is installed to be a terminal device executing the processing of the present disclosure.

The configurations and the processing that are written in the claims of the present disclosure are not limited to the examples of the above-described embodiments. It should be understood by those skilled in the art that various modifications, combinations, and other exemplary embodiments may occur depending on design and/or other factors insofar as they are within the scope of the claims or the equivalents thereof, as a matter of course.

The present disclosure may be configured as below.

(1) An information processing apparatus, including: circuitry configured to acquire image data captured by an image capturing device; perform an analysis on the image data prior to cropping the image data for display to detect a specified image from the image data; generate an image for display by cropping the image data; control a display to display the image for display; and execute predetermined processing when the specified image is detected in the image data as a result of performing the analysis on the image data prior to the cropping.

(2) The information processing apparatus of (1), further comprising: the image capturing device configured to capture the image data.

(3) The information processing apparatus of any of (1) to (2), wherein the circuitry is configured to: perform the analysis on the image data by detecting a hand in the image data; and execute the predetermined processing based on the detection of the hand in the image data.

(4) The information processing apparatus of any of (1) to (3), wherein the circuitry is configured to: perform the analysis on the image data by detecting a hand in a portion of the image data that is cropped and not included in the image for display; and execute the predetermined processing

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based on the detection of the hand in the portion of the image data that is cropped and not included in the image for display.

(5) The information processing apparatus of any of (1) to (4), wherein the circuitry is configured to: perform the analysis on the image data by detecting a gesture made by a hand in the image data; and execute the predetermined processing based on the detection of the gesture made by the hand in the image data.

(6) The information processing apparatus of any of (1) to (5), wherein the circuitry is configured to: perform the analysis on the image data by detecting a gesture made by a hand in a portion of the image data that is cropped and not included in the image for display; and execute the predetermined processing based on the detection of the gesture made by the hand in the portion of the image data that is cropped and not included in the image for display.

(7) The information processing apparatus of (6), wherein the circuitry is configured to: determine that the gesture made by the hand detected by the analysis on the image data corresponds to a command to rotate a base to which the information processing apparatus is coupled; and control the base to rotate based on the detected gesture made by the hand.

(8) The information processing apparatus of any of (6) to (7), wherein the circuitry is configured to: determine that the gesture made by the hand detected by the analysis on the image data corresponds to a command to change a tilt angle of a base to which the information processing apparatus is coupled; and control the base to tilt based on the detected gesture made by the hand.

(9) The information processing apparatus of any of (6) to (8), wherein the circuitry is configured to: determine that the gesture made by the hand detected by the analysis on the image data corresponds to a command to perform a zoom operation corresponding to the image for display; and control the display to enlarge the image for display based on the detected gesture made by the hand.

(10) The information processing apparatus of any of (6) to (9), wherein the circuitry is configured to: determine that the gesture made by the hand detected by the analysis on the image data corresponds to a command to perform an image capture operation; and control the image capturing device to capture an image based on the detected gesture made by the hand.

(11) A method performed by an information processing apparatus, the method comprising: acquiring image data captured by an image capturing device; performing an analysis on the image data prior to cropping the image data for display to detect a specified image from the image data; generating an image for display by cropping the image data; controlling a display to display the image for display; and executing predetermined processing when the specified image is detected in the image data as a result of performing the analysis on the image data prior to the cropping.

(12) A non-transitory computer-readable medium including computer-program instructions, which when executed by an information processing apparatus, cause the information processing apparatus to: acquire image data captured by an image capturing device; perform an analysis on the image data prior to cropping the image data for display to detect a specified image from the image data; generate an image for display by cropping the image data; control a display to display the image for display; and execute predetermined processing when the specified image is detected in the image data as a result of performing the analysis on the image data prior to the cropping.

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The invention claimed is:

1. An information processing apparatus, comprising: circuitry configured to
  - acquire moving image data captured by a moving image capturing device;
  - generate a moving image for display by cropping the moving image data;
  - perform an analysis on the moving image data by detecting a hand in a portion of the moving image data that is cropped and not included in the moving image for display;
  - control a display to display the generated moving image after cropping the moving image data for display; and
  - execute predetermined processing based on the detection of the hand in the portion of the moving image data that is cropped and not included in the moving image for display, wherein
    - the predetermined processing comprises determining that a gesture made by the hand detected by the analysis on the moving image data corresponds to a predetermined command, and
    - the circuitry is configured to control the display to display the generated moving image after cropping the moving image data for display while keeping acquiring the moving image data including the moving image data that is cropped and not included in the moving image for display so that the circuitry can execute the predetermined processing based on the detection of the hand in the portion of the moving image data that is cropped and not included in the moving image for display even after the hand in the portion of the moving image data is cropped and not included in the moving image for display.
2. The information processing apparatus of claim 1, further comprising:
  - the moving image capturing device configured to capture the moving image data.
3. The information processing apparatus of claim 1, wherein the circuitry is configured to:
  - determine that the gesture made by the hand detected by the analysis on the moving image data corresponds to a command to rotate the base to which the information processing apparatus is coupled; and
  - control the base to rotate based on the detected gesture made by the hand.
4. The information processing apparatus of claim 1, wherein the circuitry is configured to:
  - determine that the gesture made by the hand detected by the analysis on the moving image data corresponds to a command to perform a zoom operation corresponding to the moving image for display; and
  - control the display to enlarge the moving image for display based on the detected gesture made by the hand.
5. The information processing apparatus of claim 1, wherein the circuitry is configured to:
  - determine that the gesture made by the hand detected by the analysis on the moving image data corresponds to a command to perform a moving image capture operation; and
  - control the moving image capturing device to capture a moving image based on the detected gesture made by the hand.
6. The information processing apparatus of claim 1, wherein the circuitry is configured to:
  - determine that the gesture made by the hand detected by the analysis on the moving image data corresponds to



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a tip of a user's finger being pointed upright and rotated in a clockwise or counter clockwise direction; and control the display to enlarge or reduce a size of the moving image for display based on the detected gesture made by the hand.

7. The information processing apparatus of claim 1, wherein the circuitry is configured to:

compare a pattern of the gesture made by the hand detected by the analysis on the moving image data to stored pattern data corresponding to a command to rotate the base to which the information processing apparatus is coupled; and

control the base to rotate based on the detected gesture made by the hand when the pattern of the gesture made by the hand matches the stored pattern data.

8. The information processing apparatus of claim 1, wherein the circuitry is configured to:

compare a pattern of the gesture made by the hand detected by the analysis on the moving image data to stored pattern data corresponding to the command to change the tilt angle of the base to which the information processing apparatus is coupled; and

control the base to tilt based on the detected gesture made by the hand when the pattern of the gesture made by the hand matches the stored pattern data.

9. The information processing apparatus of claim 1, wherein the circuitry is configured to:

compare a pattern of the gesture made by the hand detected by the analysis on the moving image data to stored pattern data corresponding to a command to perform a zoom operation corresponding to the moving image for display; and

control the display to enlarge the moving image for display based on the detected gesture made by the hand when the pattern of the gesture made by the hand matches the stored pattern data.

10. The information processing apparatus of claim 1, wherein the circuitry is configured to:

compare a pattern of the gesture made by the hand detected by the analysis on the moving image data to stored pattern data corresponding to a command to perform a moving image capture operation; and

control the moving image capturing device to capture a moving image based on the detected gesture made by the hand when the pattern of the gesture made by the hand matches the stored pattern data.

11. The information processing apparatus of claim 1, wherein

the predetermined processing comprises determining that the gesture made by the hand detected by the analysis on the moving image data corresponds to a command to change a tilt angle of a base to which the information processing apparatus is coupled, and controlling the base to tilt based on the detected gesture made by the hand.

12. A method performed by an information processing apparatus, the method comprising:

acquiring moving image data captured by a moving image capturing device;

generating a moving image for display by cropping the moving image data;

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performing an analysis on the moving image data by detecting a hand in a portion of the moving image data that is cropped and not included in the moving image for display;

controlling a display to display the generated moving image after cropping the moving image data for display; and

executing predetermined processing based on the detection of the hand in the portion of the moving image data that is cropped and not included in the moving image for display, wherein

the predetermined processing comprises determining that a gesture made by the hand detected by the analysis on the moving image data corresponds to a predetermined command, and

the controlling includes controlling the display to display the generated moving image after cropping the moving image data for display while keeping acquiring the moving image data including the moving image data that is cropped and not included in the moving image for display so that the circuitry can execute the predetermined processing based on the detection of the hand in the portion of the moving image data that is cropped and not included in the moving image for display even after the hand in the portion of the moving image data is cropped and not included in the moving image for display.

13. A non-transitory computer-readable medium including computer-program instructions, which when executed by an information processing apparatus, cause the information processing apparatus to:

acquire moving image data captured by a moving image capturing device;

generate a moving image for display by cropping the moving image data;

perform an analysis on the moving image data by detecting a hand in a portion of the moving image data that is cropped and not included in the moving image for display;

control a display to display the generated moving image after cropping the moving image data for display; and execute predetermined processing based on the detection of the hand in the portion of the moving image data that is cropped and not included in the moving image for display, wherein

the predetermined processing comprises determining that a gesture made by the hand detected by the analysis on the moving image data corresponds to a predetermined command, and

the control of the display includes controlling the display to display the generated moving image after cropping the moving image data for display while keeping acquiring the moving image data including the moving image data that is cropped and not included in the moving image for display so that the circuitry can execute the predetermined processing based on the detection of the hand in the portion of the moving image data that is cropped and not included in the moving image for display even after the hand in the portion of the moving image data is cropped and not included in the moving image for display.

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